

CLAIMS

1. A general drive control system provided in a machine including a plurality of actuators and an energy source common to the actuators,
5 accomplishing a work by an operation of said plurality of actuators consuming energy supplied by said energy source, comprising
a control apparatus generally controlling drive of said plurality of actuators, based on power or work of each of said plurality of actuators.
- 10 2. The general drive control system according to claim 1, wherein said work is classified into at least one of force, heat, sound and light.
3. The general drive control system according to claim 1, wherein said plurality of actuators are of mutually different type.
- 15 4. The general drive control system according to any of claims 1 to 3, wherein
said control apparatus generally controls drive of said plurality of actuators based on a total power or a total work that is a sum of power or
20 work approximately at the same time period, of said plurality of actuators.
5. The general drive control system according to any of claims 1 to 4, wherein
said control apparatus generally controls drive of said plurality of
25 actuators such that said power or work of each of said actuators or said total power or total work of said plurality of actuators does not exceed an allowable value.
- 30 6. The general drive control system according to claim 5, wherein said control apparatus includes a power limiting unit limiting, when said total power or total work is about to exceed said allowable value, power of at least a part of said plurality of actuators in accordance with an order set in advance for said plurality of actuators.

7. The general drive control systems according to any of claims 1 to 6, further comprising

a driving request determining apparatus determining a driving request for said machine; wherein

said control apparatus determines said power or said work based on the determined driving request as a desired power or desired work, and generally controls drive of said plurality of actuators based on the determined desired power or desired work.

8. The general drive control system according to claim 7, wherein said driving request determining apparatus includes

a driving information detector detecting at least one of a driver's instruction driving said machine, state of operation of said machine, and operation environment in which said machine is placed, as driving information, and

a driving request determining unit determining said driving request based on the detected driving information; and

said control apparatus generally controls drive of said plurality of actuators based on said power or work based on the determined driving request.

9. The general drive control system according to claims 7 or 8, wherein

said control apparatus determines, based on said determined driving request, said power or work to meet the driving request as a desired power or desired work for each of said actuators, and based on the determined desired power or desired work, generally controls drive of said plurality of actuators.

10. The general drive control system according to any of claims 7 to 9, wherein

said control apparatus includes

a desired power determining unit determining, for each of said actuators, power to meet said determined driving request as a desired power;

5 a required electric power determining unit determining required electric power to be supplied to each actuator to realize the desired power determined for each of said actuators;

10 a desired power establishing unit establishing, when a total required electric power as a sum of required electric power determined for the plurality of actuators exceeds said allowable value, desired power for each of the plurality of actuators by decreasing corresponding desired power of some of said plurality of actuators; and

a driving unit driving said plurality of actuators based on the established desired power.

15 11. The general drive control system according to claim 10, wherein said desired power establishing unit decreases desired power determined for some of said actuators, in accordance with an order set in advance for said plurality of actuators, when said total required electric power exceeds said allowable value.

20 12. The general drive control system according to any of claims 7 to 9, wherein

said control apparatus includes

25 a desired power determining unit determining, for each of said actuators, power to meet said determined driving request as desired power;

a desired work determining unit determining, for each of said actuators, desired work based on said determined desired power;

30 a total work determining unit determining, as a total work, a sum of the plurality of desired works determined for respective ones of said plurality of actuators;

a desired power establishing unit establishing desired power for each of said plurality of actuators by decreasing, for some of said plurality of actuators, corresponding desired power, when the determined total work

exceeds said allowable value; and

a driving unit driving said plurality of actuators based on the established desired power.

5 13. The general drive control system according to claim 12, wherein
said desired power establishing unit decreases the desired power
determined for some of said actuators, in accordance with an order set in
advance for said plurality of actuators, when said total work exceeds said
allowable value.

10 14. The general drive control system according to claim 12 or 13,
wherein

 said driving unit determines, for each of said actuators, electric
power to be supplied to each actuator as supplied electric power, based on
15 said established desired power, and drives each of said actuators with the
determined supplied electric power.

 15. The general drive control system according to any of claims 5 to
14, wherein
20 said control apparatus includes a control mode changing unit
manually or automatically changing said allowable value, thereby changing
control mode for controlling said plurality of actuators.

 16. The general drive control system according to claim 15, wherein
25 said control mode changing unit selects as said control mode an
economy mode in which saving of energy consumed by said plurality of
actuators is given higher priority than realization of a target state of
operation of said machine, by setting said allowable value to a small value,
in a normal state of operation of said machine, and selects as said control
30 mode a power-mode in which realization of the target state of operation of
said machine is given higher priority than said saving of energy
consumption, by setting said allowable value to a large value, in an
emergency state of operation of said machine, and

said control apparatus generally controls drive of said plurality of actuators in accordance with the selected control mode.

5 17. The general drive control system according to any of claims 1 to 16, wherein

said plurality of actuators constitute a consumption unit consuming energy supplied from said energy source;

said energy source includes

a generating unit generating said energy, and

10 a storage unit storing the generated energy; and

said control apparatus includes

an apparent value determining unit determining an apparent value of said power or said work based on actual power or actual work of each of said actuators, energy generation ratio or energy generation amount by
15 said generating unit, and energy storage ratio or storage amount by said storage unit, and

a control unit generally controlling drive of said plurality of actuators, based on the determined apparent value.

20 18. The general drive control system according to any of claims 1 to 17, wherein

said control apparatus includes a master control unit provided common to said plurality of actuators and generally managing the plurality of actuators, and the master control unit generally controls drive of said
25 plurality of actuators based on said power or said work.

19. The general drive control system according to claim 18, wherein
said master control unit enables realization of the target state of operation of said machine by said plurality of actuators and saving of
30 energy consumed by the plurality of actuators.

20. The general drive control system according to claim 18 or 19, wherein

said control apparatus includes a plurality of individual control units connected to said master control unit and individually controlling each of said actuators, and each individual control unit communicates with said master control unit.

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21. The general drive control system according to any of claims 18 to 20, further comprising

an energy detector provided for each of said actuators, for detecting at least one of input energy input to each actuator and an output energy output from each actuator, connected to said master control unit and to the individual control unit corresponding to each actuator.

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22. The general drive control system according to any of claims 1 to 21, wherein

said machine is a moving body that itself moves, by the operation of at least part of said plurality of actuators.

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23. The general drive control system according to any of claims 1 to 22, wherein

when said machine is a vehicle, said actuators are at least two selected from an engine, a driving apparatus, a steering, a brake, an air conditioner and a light.

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24. The general drive control system according to any of claims 1 to 23, wherein

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said machine is a moving body used by a human being, and said control apparatus generally controls drive of said plurality of actuators by distributing among the plurality of actuators, available power or available work, which is the power or work that can be supplied by said energy source to the plurality of actuators as a whole, based on a safety variable related to safety of the moving body, a comfort variable related to comfort enjoyed by the human being using the moving body, and an economy variable related to economy of energy consumption by said

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plurality of actuators.

25. A general drive control system provided in a machine including a plurality of actuators and an energy source common to the actuators, and accomplishing a work by an operation of said plurality of actuators consuming energy supplied by said energy source, comprising control means for generally controlling drive of said plurality of actuators based on power or work of each of said plurality of actuators.

26. The general drive control system according to claim 25, wherein said work is classified into at least one of force, heat, sound and light.

27. The general drive control system according to claim 25, wherein said plurality of actuators are of mutually different type.

28. The general drive control system according to any of claims 25 to 27, wherein said control means includes means for generally controlling drive of said plurality of actuators based on a total power or a total work that is a sum of power or work approximately at the same time period, of said plurality of actuators.

29. The general drive control system according to any of claims 25 to 28, wherein said control means includes means for generally controlling drive of said plurality of actuators such that said power or work of each of said actuators or said total power or total work of said plurality of actuators does not exceed an allowable value.

30. The general drive control system according to claim 29, wherein said control means includes power limiting means for limiting, when said total power or total work is about to exceed said allowable value, power of at least a part of said

plurality of actuators in accordance with an order set in advance for said plurality of actuators.

5 31. The general drive control system according to any of claims 25 to 30, further comprising
driving request determining means for determining a driving request for said machine; wherein

10 said control means includes means for determining said power or said work based on the determined driving request as a desired power or desired work, and for generally controlling drive of said plurality of actuators based on the determined desired power or desired work.

15 32. The general drive control system according to claim 31, wherein said driving request determining means includes
driving information detecting means for detecting at least one of a driver's instruction driving said machine, state of operation of said machine, and operation environment in which said machine is placed, as driving information, and

20 driving request determining means for determining said driving request based on the detected driving information; and

 said control means includes means for generally controlling drive of said plurality of actuators based on said power or work based on the determined driving request.

25 33. The general drive control system according to claim 31 or 32, wherein

30 said control apparatus includes means for determining, based on said determined driving request, said power or work to meet the driving request as a desired power or desired work for each of said actuators, and based on the determined desired power or desired work, for generally controlling drive of said plurality of actuators.

34. The general drive control system according to any of claims 31

to 33, wherein

said control means includes

desired power determining means for determining, for each of said
actuators, power to meet said determined driving request as a desired
5 power;

required electric power determining means for determining required
electric power to be supplied to each actuator to realize the desired power
determined for each of said actuators;

desired power establishing means for establishing, when a total
10 required electric power as a sum of required electric powers determined for
the plurality of actuators exceeds said allowable value, desired power for
each of the plurality of actuators by decreasing corresponding desired
power of some of said plurality of actuators; and

driving means for driving said plurality of actuators based on the
15 established desired power.

35. The general drive control system according to claim 34, wherein
said desired power establishing means includes means for decreasing
desired power determined for some of said actuators, in accordance with an
20 order set in advance for said plurality of actuators, when said total required
electric power exceeds said allowable value.

36. The general drive control system according to any of claims 31
to 33, wherein
25 said control means includes
desired power determining means for determining, for each of said
actuators, power to meet said determined driving request as desired power;
desired work determining means for determining, for each of said
actuators, desired work based on said determined desired power;
30 total work determining means for determining, as a total work, a
sum of the plurality of desired works determined for respective ones of said
plurality of actuators;
desired power establishing means for establishing desired power for

each of said plurality of actuators by decreasing, for some of said plurality of actuators, corresponding desired power, when the determined total work exceeds said allowable value; and

5 driving means for driving said plurality of actuators based on the established desired power.

37. The general drive control system according to claim 36, wherein said desired power establishing means includes means for decreasing the desired power determined for some of said actuators, in accordance with
10 an order set in advance for said plurality of actuators, when said total work exceeds said allowable value.

38. The general drive control system according to claim 36 or 37, wherein
15 said driving means includes means for determining, for each of said actuators, electric power to be supplied to each actuator as supplied electric power, based on said established desired power, and for driving each of said actuators with the determined supplied electric power.

20 39. The general drive control system according to any of claims 29 to 38, wherein said control means includes control mode changing means for manually or automatically changing said allowable value, thereby changing control mode for controlling said plurality of actuators.

25 40. The general drive control system according to claim 39, wherein said control mode changing means includes means for selecting as said control mode an economy mode in which saving of energy consumed by said plurality of actuators is given higher priority than realization of a
30 target state of operation of said machine, by setting said allowable value to a small value, in a normal state of operation of said machine, and for selecting as said control mode a power-mode in which realization of the target state of operation of said machine is given higher priority than said

saving of energy consumption, by setting said allowable value to a large value, in an emergency state of operation of said machine, and

said control means includes means for generally controlling drive of said plurality of actuators in accordance with the selected control mode.

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41. The general drive control system according to any of claims 25 to 40, wherein

said plurality of actuators constitute a consumption unit consuming energy supplied from said energy source;

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said energy source includes

a generating unit generating said energy, and

a storage unit storing the generated energy; and

said control means includes

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apparent value determining means for determining an apparent value of said power or said work based on actual power or actual work of each of said actuators, energy generation ratio or energy generation amount by said generating unit, and energy storage ratio or storage amount by said storage unit, and

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control means for generally controlling drive of said plurality of actuators.

42. The general drive control system according to any of claims 25 to 41, wherein

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said control means includes a master control unit provided common to said plurality of actuators and generally managing the plurality of actuators, and the master control unit generally controls drive of said plurality of actuators based on said power or said work.

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43. The general drive control system according to claim 42, wherein said master control unit enables realization of the target state of operation of said machine by said plurality of actuators and saving of energy consumed by the plurality of actuators.

44. The general drive control system according to claim 42 or 43, wherein

5 said control means includes a plurality of individual control units connected to said master control unit and individually controlling each of said actuators, and each individual control unit communicates with said master control unit.

45. The general drive control system according to any of claims 42 to 44, further comprising
10 energy detecting means provided for each of said actuators, for detecting at least one of input energy input to each actuator and an output energy output from each actuator, connected to said master control unit and to the individual control unit corresponding to each actuator.

15 46. The general drive control system according to any of claims 25 to 45 wherein
said machine is a moving body that itself moves, by the operation of at least part of said plurality of actuators.

20 47. The general drive control system according to any of claims 25 to 46, wherein
when said machine is a vehicle, said actuators are at least two selected from an engine, a driving apparatus, a steering, a brake, an air conditioner and a light.

25 48. The general drive control system according to any of claims 25 to 47, wherein
said machine is a moving body used by a human being, and
30 said control means includes means for generally controlling drive of said plurality of actuators by distributing among the plurality of actuators, available power or available work, which is the power or work that can be supplied by said energy source to the plurality of actuators as a whole, based on a safety variable related to safety of the moving body, a comfort

variable related to comfort enjoyed by the human being using the moving body, and an economy variable related to economy of energy consumption by said plurality of actuators.

- 5 49. A general drive control method, implemented in a machine including a plurality of actuators and an energy source common to the actuators, for accomplishing a work by an operation of said plurality of actuators consuming energy supplied by said energy source, comprising the step of
- 10 generally controlling drive of said plurality of actuators based on power or work of each of said plurality of actuators.

50. The general drive control method according to claim 49, wherein
- 15 said work is classified into at least one of force, heat, sound and light.

51. The general drive control method according to claim 49, wherein
- 20 said plurality of actuators are of mutually different type.

52. The general drive control method according to any of claims 49 to 51, wherein
- 25 said step of generally controlling drive of said actuators includes the step of controlling drive of said plurality of actuators based on a total power or a total work that is a sum of power or work approximately at the same time period, of said plurality of actuators.

53. The general drive control method according to any of claims 49 to 52, wherein
- 30 said step of generally controlling drive of said actuators includes the step of controlling drive of said plurality of actuators such that said power or work of each of said actuators or said total power or total work of said plurality of actuators does not exceed an allowable value.

54. The general drive control method according to claim 53,
wherein

5 said step of generally controlling drive of said actuators includes the
step of limiting, when said total power or total work is about to exceed said
allowable value, power of at least a part of said plurality of actuators in
accordance with an order set in advance for said plurality of actuators.

10 55. The general drive control method according to any of claims 49
to 54, further comprising the step of determining a driving request for said
machine; wherein

15 said step of generally controlling drive of said actuators includes the
step of determining said power or said work based on the determined
driving request as a desired power or desired work, and controlling drive of
said plurality of actuators based on the determined desired power or
desired work.

56. The general drive control method according to claim 55,
wherein

20 said driving request determining step includes the steps of
detecting at least one of a driver's instruction driving said machine,
state of operation of said machine, and operation environment in which
said machine is placed, as driving information, and

25 determining said driving request based on the detected driving
information; and

said step of generally controlling drive of said actuators includes the
step of controlling drive of said plurality of actuators based on said power
or work based on the determined driving request.

30 57. The general drive control method according to claim 55 or 56,
wherein

said step of generally controlling drive of said actuators includes the
step of determining, based on said determined driving request, said power

or work to meet the driving request as a desired power or desired work for each of said actuators, and based on the determined desired power or desired work, controlling drive of said plurality of actuators.

- 5 58. The general drive control method according to any of claims 55 to 57, wherein
- said step of generally controlling drive of said actuators includes the steps of
- determining, for each of said actuators, power to meet said
- 10 determined driving request as a desired power;
- determining required electric power to be supplied to each actuator to realize the desired power determined for each of said actuators, as required electric power;
- establishing, when a total required electric power as a sum of
- 15 required electric power determined for the plurality of actuators exceeds said allowable value, desired power for each of the plurality of actuators by decreasing corresponding desired power of some of said plurality of actuators; and
- driving said plurality of actuators based on the established desired
- 20 power.

59. The general drive control method according to claim 58, wherein
- said step of establishing desired power includes the step of
- 25 decreasing desired power determined for some of said actuators, in accordance with an order set in advance for said plurality of actuators, when said total required electric power exceeds said allowable value.

60. The general drive control method according to any of claims 55 to 57, wherein
- 30 said step of generally controlling drive of said actuators includes the steps of
- determining, for each of said actuators, power to meet said

determined driving request as desired power;

determining, for each of said actuators, desired work based on said determined desired power;

5 determining, as a total work, a sum of the plurality of desired works determined for respective ones of said plurality of actuators;

establishing desired power for each of said plurality of actuators by decreasing, for some of said plurality of actuators, corresponding desired power, when the determined total work exceeds said allowable value; and

10 driving said plurality of actuators based on the established desired power.

61. The general drive control method according to claim 60, wherein

15 said step of establishing desired power includes the step of decreasing the desired power determined for some of said actuators, in accordance with an order set in advance for said plurality of actuators, when said total work exceeds said allowable value.

20 62. The general drive control method according to claim 60 or 61, wherein

said step of driving actuators includes the step of determining, for each of said actuators, electric power to be supplied to each actuator as supplied electric power, based on said established desired power, and driving each of said actuators with the determined supplied electric power.

25 63. The general drive control method according to any of claims 53 to 62, wherein

30 said step of generally controlling drive of said actuators includes the step of manually or automatically changing said allowable value, thereby changing control mode for controlling said plurality of actuators.

64. The general drive control method according to claim 63, wherein

said step of changing control mode includes the step of selecting, as said control mode an economy mode in which saving of energy consumed by said plurality of actuators is given higher priority than realization of a target state of operation of said machine, by setting said allowable value to a small value, in a normal state of operation of said machine, and selecting, as said control mode a power-mode in which realization of the target state of operation of said machine is given higher priority than said saving of energy consumption, by setting said allowable value to a large value, in an emergency state of operation of said machine, and

said step of generally controlling drive of said actuators includes the step of controlling drive of said plurality of actuators in accordance with the selected control mode.

65. The general drive control method according to any of claims 49 to 64, wherein

said plurality of actuators constitute a consumption unit consuming energy supplied from said energy source;

said energy source includes

a generating unit generating said energy, and

a storage unit storing the generated energy; and

said step of generally controlling drive of said actuators includes the step of

determining an apparent value of said power or said work based on actual power or actual work of each of said actuators, energy generation ratio or energy generation amount by said generating unit, and energy storage ratio or storage amount by said storage unit, and

controlling drive of said plurality of actuators based on the determined apparent value.

66. The general drive control method according to any of claims 49 to 65, wherein

said step of generally controlling drive of said actuators is executed by a master control unit provided common to said plurality of actuators and

generally managing the plurality of actuators, and the master control unit controls drive of said plurality of actuators based on said power or said work.

5 67. The general drive control method according to claim 66, wherein

 said master control unit enables realization of the target state of operation of said machine by said plurality of actuators and saving of energy consumed by the plurality of actuators.

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 68. The general drive control method according to claim 66 or 67, further comprising the step of

 communicating between said master control unit and a plurality of individual control units individually managing each of said actuators.

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 69. The general drive control method according to any of claims 66 to 68, further comprising the step of

 detecting, for each of said actuators, at least one of input energy input to each actuator and an output energy output from each actuator.

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 70. The general drive control method according to any of claims 49 to 69, wherein

 said machine is a moving body that itself moves, by the operation of at least part of said plurality of actuators.

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 71. The general drive control method according to any of claims 49 to 70, wherein

 when said machine is a vehicle, said actuators are at least two selected from an engine, a driving apparatus, a steering, a brake, an air conditioner and a light.

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 72. The general drive control method according to any of claims 49 to 71, wherein

said machine is a moving body used by a human being, and
said step of generally controlling drive of said plurality of actuators
includes the step of controlling drive of said plurality of actuators by
distributing among the plurality of actuators, available power or available
5 work, which is the power or work that can be supplied by said energy
source to the plurality of actuators as a whole, based on a safety variable
related to safety of the moving body, a comfort variable related to comfort
enjoyed by the human being using the moving body, and an economy
variable related to economy of energy consumption by said plurality of
10 actuators.